Army Science & Technology

Soldier Portfolio Overview

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DESIGN • DEVELOP • DELIVER • DOMINATE
SOLDIERS AS THE DECISIVE EDGE

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Soldier Vision Statement

Vision

Execute innovative Science and Technology programs which increase the effectiveness, health and reliability of the human component of the total Army allowing for rapid dominance in increasingly complex environments across a diverse range of operations

Squad as the Foundation of the Decisive Force

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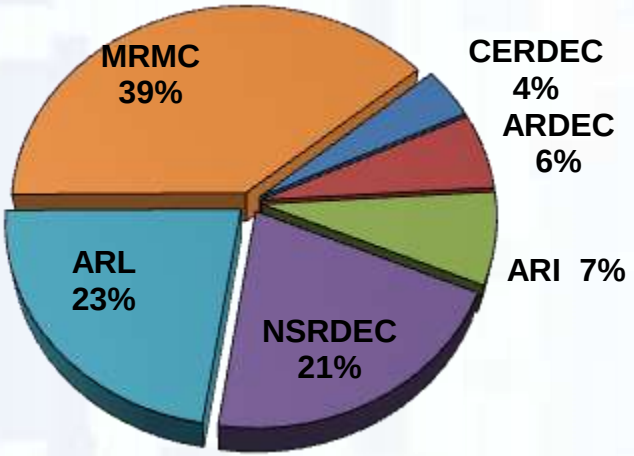
FY14

Soldier Portfolio

Soldier Portfolio
6.2 and 6.3 Funding

$377M



Human Dimension	Training	Human System Integration	Survivability	Individual /Small Unit Equipment	Combat Casualty Care
$76M	$53M	$54M	$109M	$67M	$22M
Investment Areas • Health Promotion • Personnel • Clinical Rehabilitative Medicine	**Investment Areas** • Measures and Metrics • LVCG • Leader Development	**Investment Areas** • Human Performance Modeling • Equipment Guidelines • Integration, Assessment and Demonstration	**Investment Areas** • Environmental • Head-Borne • Ballistic and Blast • Infectious Disease	**Investment Areas** • Lethality • Mobility • Logistic Support • Dismounted Soldier Mission Command • Power and Energy	**Investment Areas** • Critical Care Engineering • Damage Control Resuscitation • Combat Trauma

Source: Army Science and Technology Management Information System (ASTMIS) PB14

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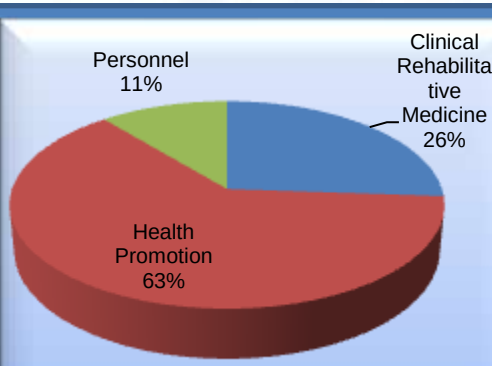
Human Dimension Sub-Portfolio

Goal: Develop solutions to assess potential, prepare for complex environments and maintain the health and effectiveness of the Army team

S&T Major Efforts include:

- **Clinical Rehabilitative Medicine:** Conducts research to enhance the ability to diagnose, stabilize, and accelerate wound healing and repair for casualties
- **Health Promotion:** Develop the analytics to predict, prevent, and reduce non-blast injuries, optimize nutrition strategies to maintain physical & mental performance and provide empirically validated interventions across the continuum of care to promote Soldier psychological resilience
- **Personnel:** Create and provide innovative behavioral and social science solutions that enable the Army to provide ready forces and required force capabilities.



Stakeholders:

- G1
- TRADOC
- OTSG
- RDECS and Labs
- PEO-STRI
- IMT

Internal Army S&T:

Researching new social, behavioral and physical performance to invent methods and measures to understand human performance of Army personnel in complex environments especially in areas that are ill-defined and unknown

Predominate Sciences:

- **Social and Behavior Sciences**
- **Biomedical Sciences**
- **Clinical Trials**
- **Longitudinal Studies**

Near-term Goals:

- **Enhance Soldier job classification**
- **Reduce attrition**
- **Improve the health of the Force**

Mid/Far-term Goals:

- **Continually assess Soldier potential and provide individualized feedback**
- **Capture, process and disseminate real-time medical information from point of injury to definitive care**
- **Predict and prevent factors impacting effective physical, cognitive and social performances**

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Return to Duty Standards After Psychological Injury Studies and Assessment

Purpose:

Provide evidence-based empirically validated guidelines that assist healthcare providers in determining optimal return-to-duty for Soldiers with psychological injuries.

Results/Products:

- Objective return-to-duty guidelines after psychological injury

Payoff:

- Established standards and strategies that are Military Occupational Specialty (MOS)-specific after psychological injury that result in a Soldier's safe return to duty

Schedule

MILESTONES	FY13	FY14	FY15	FY16	FY17
Return-to-duty guidelines after psychological injury					5 6

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Training Sub-Portfolio

Goal: Develop low cost, leap-ahead training & education (T&E) technology advancements to the current and future force

S&T Major Efforts research human performance measures and metrics which support operational training to include Initial Military Training, Professional Military Education, Civilian Education System, Functional Training, Defense Language Training, technologies for Home station and deployment stations. Technologies support structured, guided and personal self training.

Leader Development: identifying knowledge, skills & abilities underlying leadership and mission command in complex environments

Measures and Metrics: research , mature and validate measures and methods to assess and train key skills

Training Support System: research and mature technologies to support the development of instruments and training aids, devices simulators and simulation to support learning at facilities such as ranges, mission training complexes and training support centers; and training support operations and manpower.

Stakeholders:

- TRADOC
- PEO STRI
- ARL
- STTC
- ARI
- HD Task Force
- HP/RR Task Force

Internal Army S&T:

Integration of technologies which best support various mission scenarios and Tactical Tasks and assess effectiveness of adopted solutions

Predominate Sciences:

- **Social Sciences**
- **Behavioral Sciences**
- **Computer Sciences**

Near-term Goals:

- **On-demand distributed training**
- **Accessible Training Products**
- **Full-Scale Urban Ops Homestation Training**
- **Hybrid Threat Training Development**

Mid/Far-term Goals:

- **Low Overhead Immersive T&E Capability**
- **Virtual Human Capabilities**
- **Enhanced/Integrated Live Training Capability**
- **Cultural Awareness**
- **Models & Simulations for Training Effectiveness Analysis**

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Human System Integration Sub-Portfolio

Goal: Use both human modeling and analytical design to create concepts, develop performance standards and assess manufacturability gaps for technologies that could be produced to counter future threats.

S&T Major Efforts include:

- Maintain an **Assessment and Demonstration** environment for analysis of system integration opportunities which replicate mission scenarios and uses novel evaluation devices and methodologies for demonstration of traditional and nontraditional Soldier systems.
- An interdisciplinary discipline that researches physical and cognitive factors that impact **Human Performance** such as human-robotic interaction, translational neuroscience, social-cognitive understanding, as well as perception and physical performance
- Develop human based **Models and Analysis** based on experiments and data collected from human field and clinical trials to create empirical datasets needed to model human performance which can be used for policy decisions, equipment design and training.

Near-term Goals:

- **Develop laboratory based protocols and devices that replicate threat impacts to current operational scenarios**
- **Develop methodologies to rapidly assess military utility of commercially available and emerging technologies**
- **Conduct iterative levels of user assessment and demonstrations for development of industry specifications**

Mid/Far-term Goals:

- **Develop Laboratory based testing protocols and devices that predict threats impact for both current and future operational scenarios**
- **Develop mission specific equipment guidelines reflecting attributes of both the current and future Army population**
- **Reduce the need for extensive human field trials**
- **Use both human modeling and analytical design to create concepts, develop performance standards and assess manufacturability gaps for technologies**

Stakeholders:

- Industrial Base
- PEO-Soldier,
- Other S&T Portfolios, RDECs and MACOMs

Internal Army S&T:

- **Synthesizing mission tasks and scenarios and decomposition of current and future battlefield threats**
- **Developing test protocols and devices which replicate battlefield events allowing for creation of novel concepts and performance specifications**

Predominant Sciences:

- **Human Factors**
- **Biomechanics**
- **Consumer Research**
- **Robotics**
- **Psychology**
- **Neuroscience**

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Redistributing Torso Loads for Successful Execution of Mission Critical Tasks

Purpose:

To quantify and inform the impact of redistributing the torso borne fighting and approach march loads from the shoulders/back to the pelvis region (in varying degrees) on biomechanical measures of performance, mobility, situational awareness and comfort as it relates to the operational environment.

Results/Products:

- A systematic approach to alter the distribution of the torso borne body armor loads and establish/validate method to measure/quantify the redistribution of the load
- Baseline the optimal distribution of torso-borne loads as related to Soldier performance, mobility, situational awareness, and comfort
- Requirement guidance/generation for load redistribution of future body armor system and other torso borne load designs

Payoff:

- Quantifiable understanding of the impact of redistributing the torso-borne loads and identifying the optimal distribution of torso borne loads between the shoulders/back and pelvis

Schedule

Elements	FY12	FY13	FY14	FY15
Device Development & Validation; Methodology for measuring load distribution		3	4	
HF Eval - Evaluate Soldier performance as a function of load redistribution		3	4	
Biomech Eval - Evaluate Soldier performance as a function of load redistribution		3	4	

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Survivability Sub-Portfolio

Goal: Pursue component and system designs which protect against operational and environmental threats without limiting Soldier mobility, effectiveness, and lethality

S&T Major Efforts include:

Ballistic and Blast: Protection against multiple threats to balance weight, mobility, and mission effectiveness through component and system designs, engineering models and materials

•**Head Injury Protection:** Assessment and treatment for head injuries; brain, eyes, ears and mouth and coordinated efforts on protection components, system design, integration, and materials

•**Environmental Protection:** Protect against altitude, cold, heat, infectious diseases and hazardous environmental conditions.

•**Infectious Disease:** Define diagnostic tools and models for infectious identification and developing vaccines and other counter-measures

Stakeholders:

- **PEO-Soldier**
- **OTSG**
- **Battlefield Medics**

Near-term Goals:

•Reduce weight and create multi functional protection technologies wherever possible

•Increase integration of injury analysis and human physiology with component and system design

•Improve Soldier mobility, effectiveness, and lethality through system level performance data and mission trade analysis

•Partner with industrial base

Mid/Far-term Goals:

•Develop comprehensive, high fidelity human performance, injury mechanisms and material models to inform component and system design and injury outcomes

•Maturation of novel materials, treatments and processing techniques in a laboratory setting to create performance specification for industry participation

•Knowledge products and decision tools that optimize Warfigher adaptable risk management with protection and mobility enabled by technological changes including improved human situational awareness

Internal Army S&T Role:

- **Small and midscale development of novel fibers with military application**
- **Integration technologies to create multifunctional applications which can be used on the battlefield**
- **Analyzing battlefield injuries and translating injury mechanisms into measure and metrics for use in protection concept development**

Predominant Sciences:

- **Material Science**
- **Medical Science**
- **Materials and Human Modeling**
- **System Integration**

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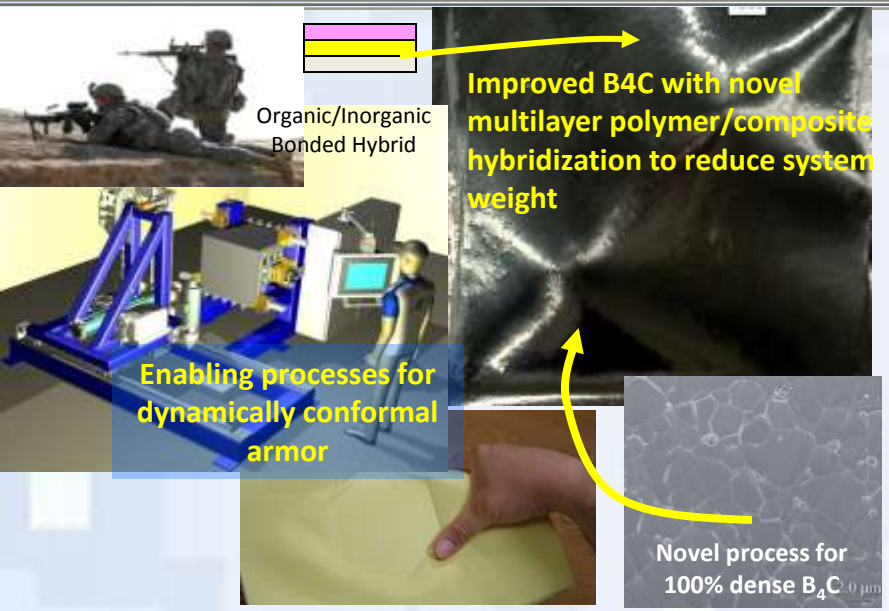
Enabling Hybridized Manufacturing Processes for Lightweight Body Armor



Purpose:

To develop innovative manufacturing processes to bridge the gap and enable the use, scale-up, and consistent quality fabrication of ballistically superior hybridized body armor materials, components, and systems.

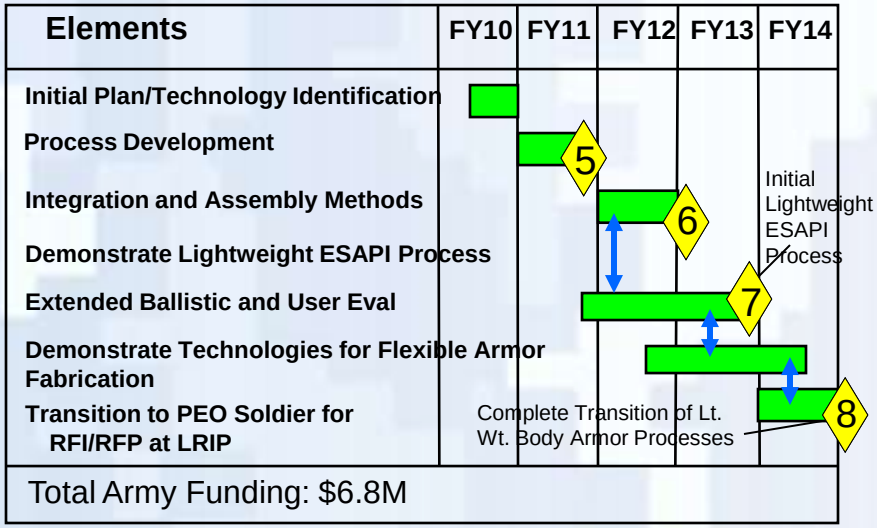
Products:

- Manufacturing processes for 25-35% increase in process throughput
- Ceramic processes for 40% increase in yield associated with thickness control in extrusion process (+/- 0.008”)
- Automated composite backing assembly process for 30-40% reduction in cycle time
- New processing technologies that enable use of less expensive ceramic powders for 30-50% cost reduction over current powder processes

Payoff:

- Cumulative 10% reduction in total ESAPI ballistic system weight
- Increased mobility, sustainability, readiness
- Enabler for dynamically conformal and flexible body armor as well as improved backing for XSAPI
- Cost Benefit of $96M with ROI of 12:1

Schedule



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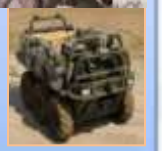
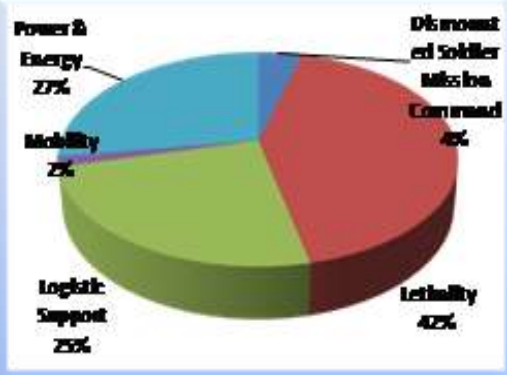
Small Unit Equipment Sub-Portfolio

Goal: Pursue integrated component and system designs which enhance Soldier/small unit performance in diverse operational environments while unburdening the Soldier/unit

S&T Major Efforts include



- **Dismounted Soldier Mission Command**: maturation of a robust and effective information and power system of systems for all informational needs.
- **Lethality:** effectively acquire targets, avoid detection caused by weapon signature and operate Solder-borne weapons for continued lethality overmatch.
- **Mobility:** technologies to move across the battlefield as needed after exiting major platforms **to include enhanced airborne precision and safety**
- **Logistic Support:** methods and technologies to sustain human performance **and quality of life** for an extended period of time in remote locations
- **Power & Energy:** research novel materials and technologies for efficiency improvements in power management and lightweight power supply systems



Stakeholders:

PEO-Soldier AFRL
PEO-CSSO OSD
TRADOC

Near-term Goals:

- **Upgrade component and systems to meet mission requirements**
- **Support ONS and JUNOs**
- **Research state-of-the-art photovoltaic concepts, fiber connection and energy harvesting**
- **Reduce weight of current systems and components**
- **Reduce reliance on fuel and water;**
- **Reduce waste in base camps**
- **Increase aerial resupply precision for on-time, on-target delivery**
- **Double small arms effective range**

Mid/Far-term Goals:

- **Guide development; leverage integration and use of robotic entities for Soldier/small unit**
- **Scalable lethality and area denial for the Soldier and small unit**
- **Situational Awareness Integration and collaboration between night vision, sensor and laser technologies and command & control for the entire Squad**
- **Computing, networking, and analysis tools to automate Soldier power maintenance and controls.**
- **Novel mobility assets to move Individual Soldier or Small Units around the battlefield**

Internal Army S&T:

- **Driving the need for lightweight, low power, small volume, ruggedized and wireless technologies and components which can be used in any environment**
- **Integrating military applications into commercial hardware and software technologies**

Predominant Sciences:

- **Mechanical and Electrical Engineering**
- **Systems Engineering**
- **Fluid Dynamics**

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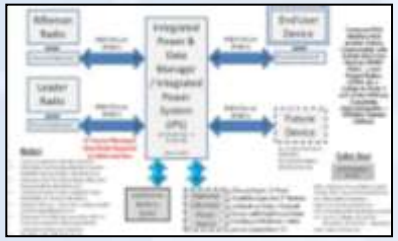
Integration of Power and Energy Demand Management

Integrated Soldier Power and Data System



Schedule

Elements	FY13	FY14	FY15
Wireless Power Transfer	4 — 5	5 — 6	6 —
Power-Aware Network/Power Management	5 — 6	6 — 7	7 —
Soldier Borne Harvesting	4 — 5	5 —	
Soldier Integration/ Evaluations			

Purpose:

To improve Soldier acceptance of electronic equipment by reducing Soldier-borne cabling and battery demand and improve Soldier integrated power and data architectures.

Results/Products:

- Wireless Power Transfer
- Power-Aware Network/Power Management and improvement efforts will be managed and tested accordingly
- Energy harvesting efforts will be managed and tested accordingly

Payoff:

- Wireless Power Transfer
- Augmentative, on-the-move, continuously recharging and distributing system reduces weight of Soldier mission power

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Combat Casualty Care Sub-Portfolio

Goal: Maximize investments which can be employed during the golden hour, the 60 minute period after trauma, after which the chances of survival for wounded Soldiers drop significantly.

S&T Major Efforts include:

- Initiate preclinical studies on contributions of the immune system, platelets, plasma, and blood clotting factors to the body's ability to properly clot blood following trauma
- Develop advanced monitoring technology to rapidly and accurately detect early-onset of blood loss, continuously estimate blood loss volume, and predict patient's risk for cardiovascular collapse
- Develop novel drugs and alternative therapeutic strategies including pharmaceutical technologies, novel stem cell strategies, and selective cooling to manage traumatic brain injury
- Initiate a proof-of-concept preclinical modeling of mild TBI/concussion in rodents

Near-term Goals:

- Initiate studies of blood vessels, platelets, and coagulation factor contributions to the body's ability to properly clot blood following trauma, as well as determine whether blood products cause inflammation.
- Develop advanced monitoring technology to rapidly and accurately detect early-onset of blood loss, continuously estimate blood loss volume, and predict patient's risk for cardiovascular collapse.
- Develop local antibiotic delivery that can be used with Negative Pressure Wound Therapy

Mid/Far-term Goals:

Mid-term:

- Identify at least one new therapeutic target through animal proof-of-concept studies.
- Have a new diagnostic and one drug in clinical/advanced development.
- Have at least one new metabolic and tissue stabilization drug/target in clinical/advanced development.

Far term:

- Gain FDA approval of dried plasma, cryopreserved platelets, a novel platelet storage technology, and a new diagnostic device.

Stakeholders:

- G1
- TRADOC
- OTSG
- RDECS and Labs

Internal Army S&T:

- MEDCOM
- BAMC
- JTTR
- ARL

Predominate Sciences:

- Blood products
- Hemostatic devices
- Tourniquets
- Diagnostic and therapeutic medical devices

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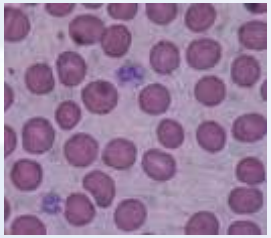
Coagulation and Blood



Purpose:

Decrease battlefield mortality due to uncontrolled bleeding by providing diagnostic and therapeutic solutions to treat the Coagulopathy of Trauma (CoT), and by providing safer, more effective, and more logistically supportable blood products delivered far-forward

Schedule

DTRA

Small Unit Trauma Care Projects	FY12	FY13	FY14	FY15	FY16	FY17	FY18
New Platelet Storage Technology			3	4		5	
Diagnostic Assay/Device for CoT				3	4		
Drug to treat CoT					3		4

Milestone Indicators: TRL or SRL: ◆ Milestone Timeline: ▬

Results/Products:

- Improved platelet (specialized blood cells needed to stop bleeding) storage technologies
- Laboratory assay for diagnosis of CoT
- Therapeutic to treat CoT

Payoff:

- Extend platelet shelf life will improve distribution of platelets on the battlefield
- Far forward use of platelets
- Early identification and treatment of casualties afflicted with CoT
- Reduce number of battlefield deaths (KIA)
- Reduce morbidity and “died of wounds” rate resulting from hemorrhage

Reference: Force Protection Deep Dive

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Soldier S&T Portfolio Summary

- Solder Portfolio Challenges
  - This Portfolio includes research leading to both material and non-material solutions
  - Generally, the quantity of end items necessary for fielding creates the need for multiple sources of supply
  - Solution sets require government integration of S&T from different areas (ie., medical, human performance, mission scenarios, and electronics) and partners (small business, academia, and production contractors) to create a capability that could be used in the field
- Disruptive and Leap-Ahead technologies will come in many forms with a basis in neuroscience, advance textiles and behavioral health or social science and will provide the Army the human edge in future conflicts

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WebPortal for Army wide Industry Engagement

Defense Innovation Marketplace

http://defenseinnovationmarketplace.mil/armyInformation.html

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Providing Soldiers Technology Enabled Capabilities

MAINTAINING A LEADING EDGE IN TECHNOLOGY